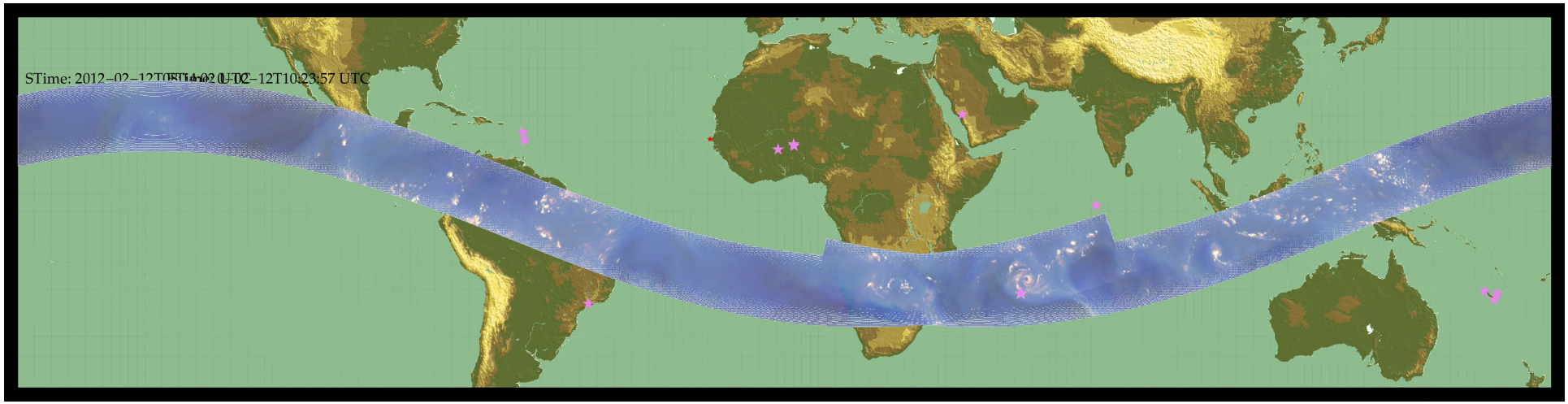
# Influence of ice-microphysics parameterization on the simulation of SAPHIR brightness temperatures



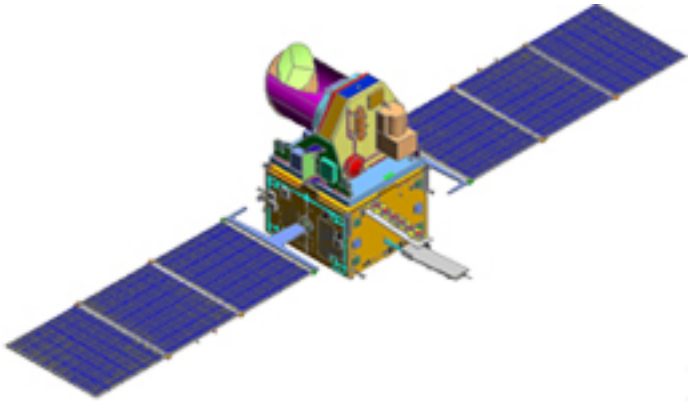

Nicolas Viltard, Audrey Martini,
Ramsès Sivira
LATMOS-IPSL
CNRS-UVSQ-UPMC

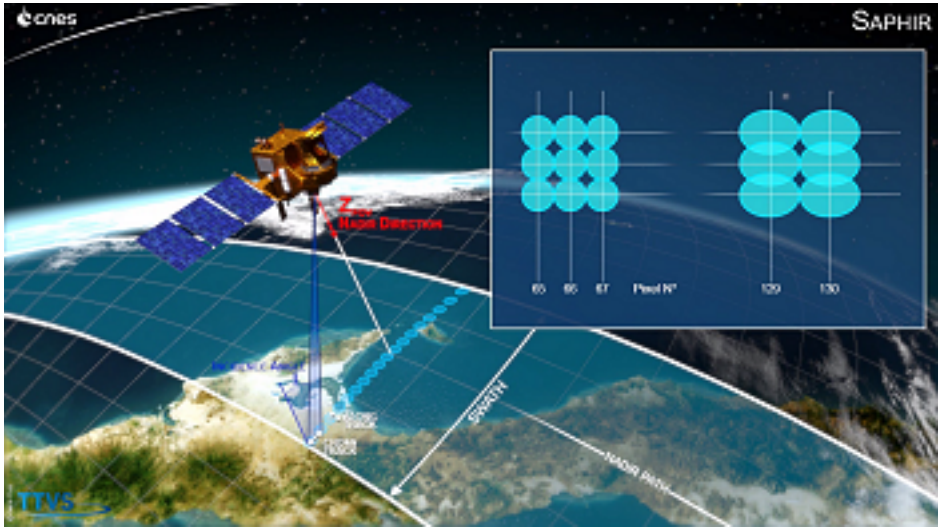
# Context

- Megha-Tropiques launched in 2011
- 3 instruments: SAPHIR, ScaRaB, MADRAS
- MADRAS worked for only 14 month…
- So we try to retrieve rain with SAPHIR
- We need to understand the $T_B$s and simulate !
- UTH retrieval => when does scattering start with SAPHIR ?
- The Hong *et al.* 2005 criteria ?

# SAPHIR Characteristics

- Cross-track passive microwave radiometer @ 183 GHz
- 6 channels: +/- 0.2, 1.1, 2.8, 4.2, 6.8, 11 MHz
- 10 km resolution @ nadir, ~40 km @ 48°
- 1700 km swath



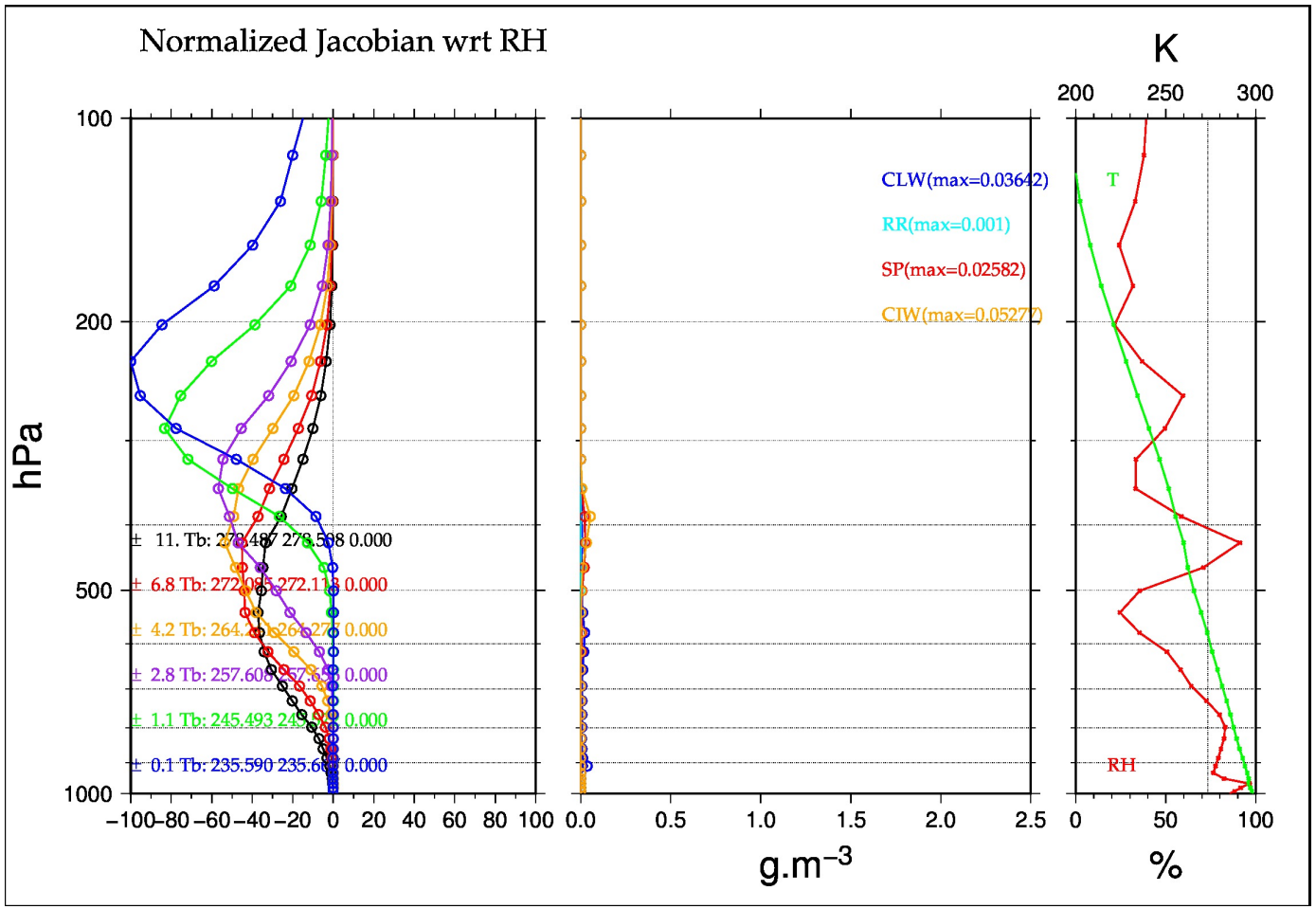


# RTM: RTTOV-scatt 11.2

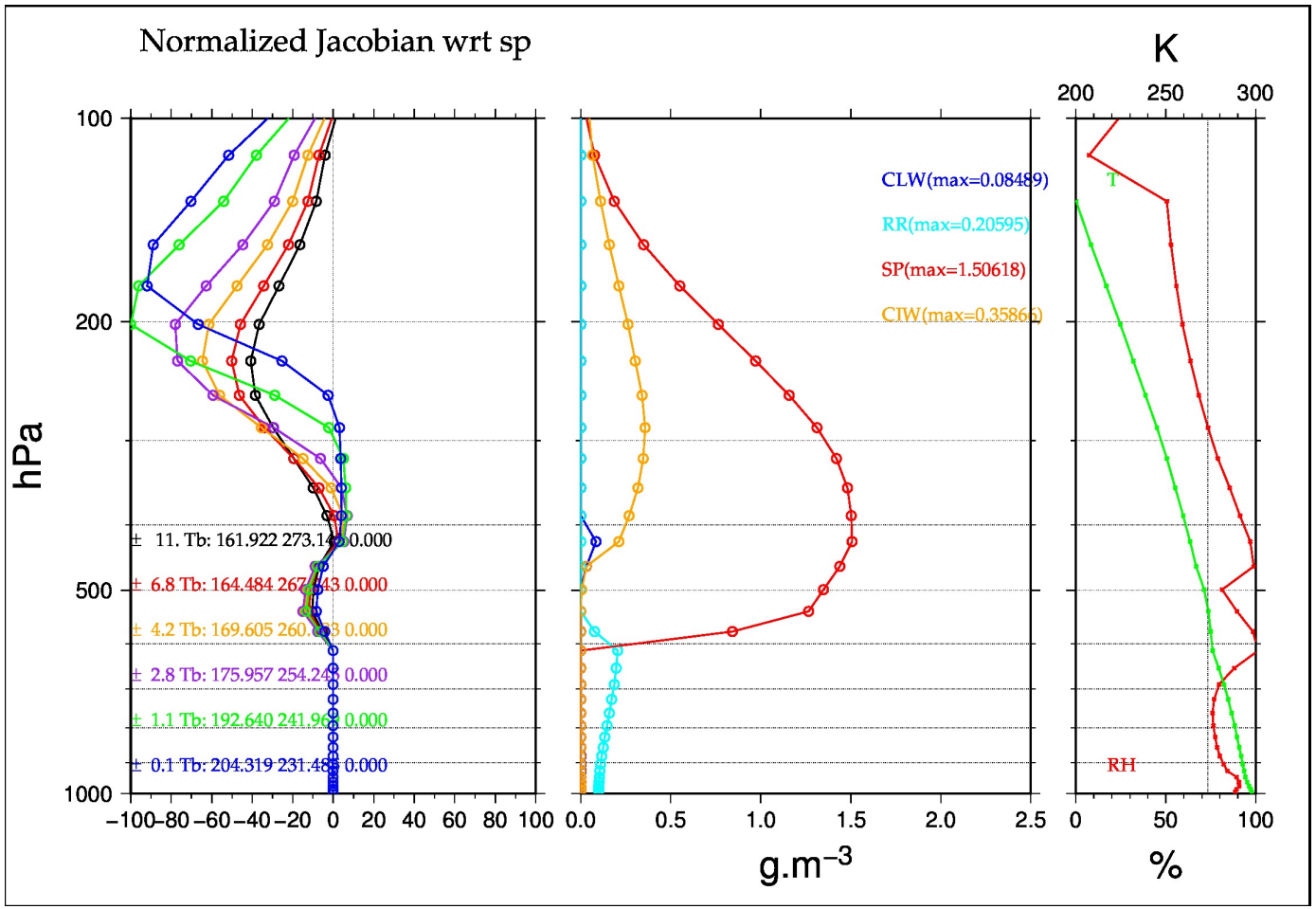
- In RTTOV-scatt: pre-computed pseudo Mie tables w/ Liu (2004, 2008) particles:
  - long hexagonal column l/d=4
  - short hexagonal col l/d=2
  - block hex col l/d=1
  - thick hex plate l/d=0.2
  - thin hex plate l/d=0.05
  - 3-bullet rosette
  - 4-bullet rosette
  - 5-bullet rosette
  - 6-bullet rosette
  - sector-like snowflake ("default" RTTOV-scatt config.)
  - dendrite snowflake

  The PSD is the one proposed by Field *et al.* 2007.

# Normalized Jacobian wrt RH, “non precip” profile

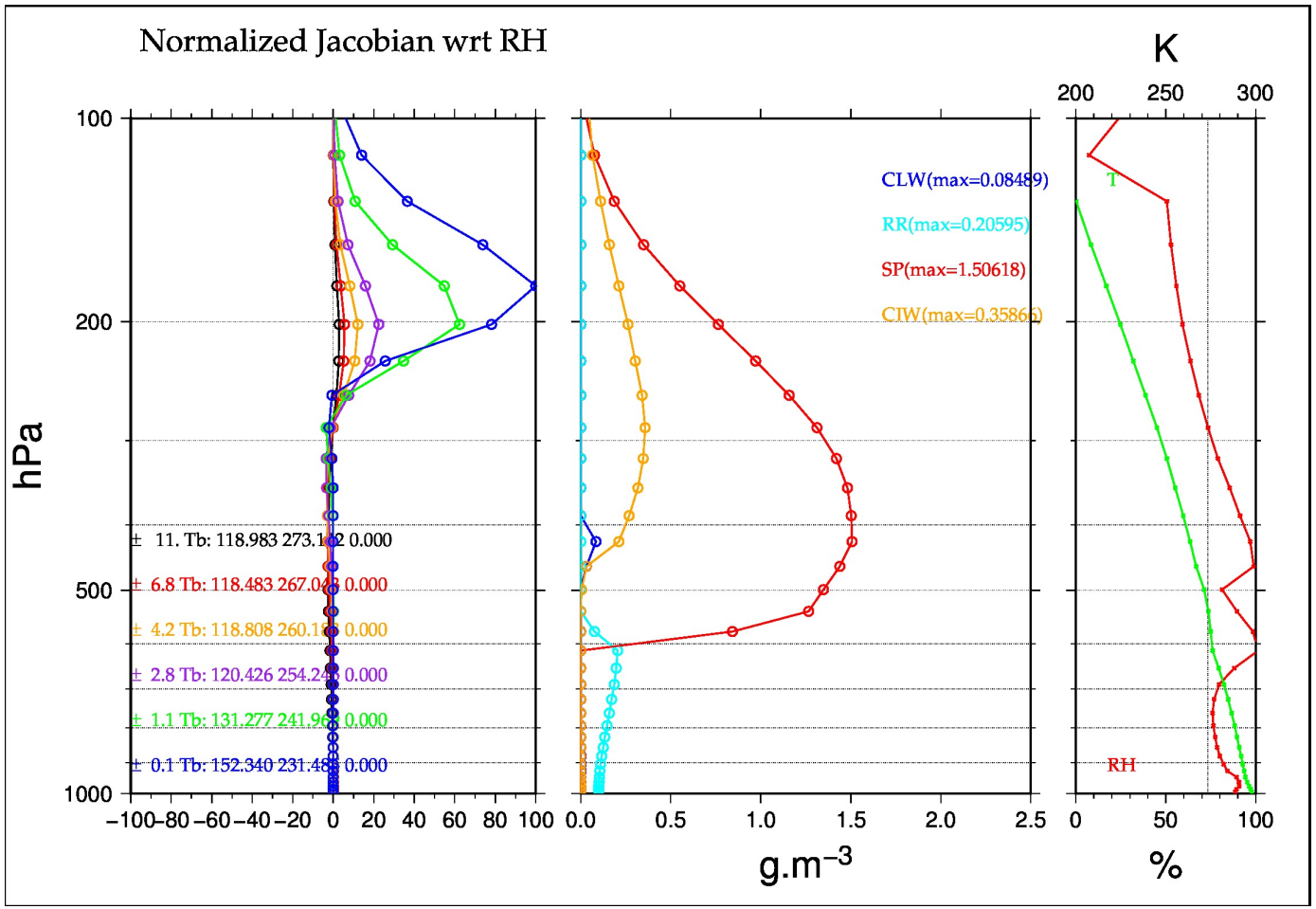


# Normalized Jacobian wrt Ice, "high" ice content profile




Confirming results from Bennartz and Bauer, 2003

# Normalized Jacobian wrt RH, "high" ice content profile



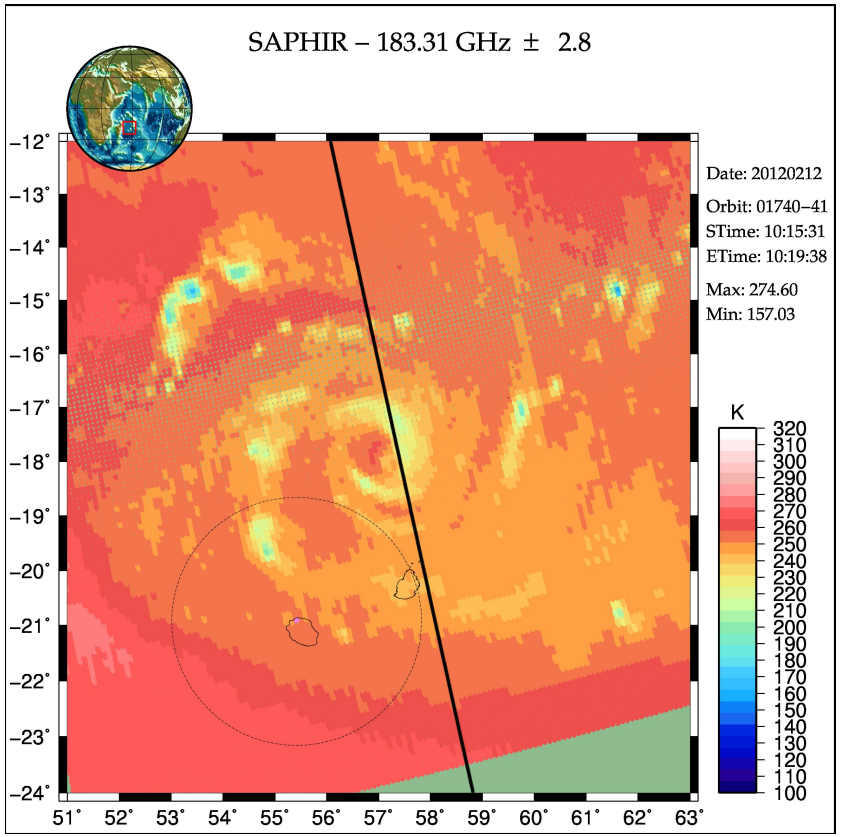

Confirming results from Bennartz and Bauer, 2003

# Co-located data between CPR and SAPHIR

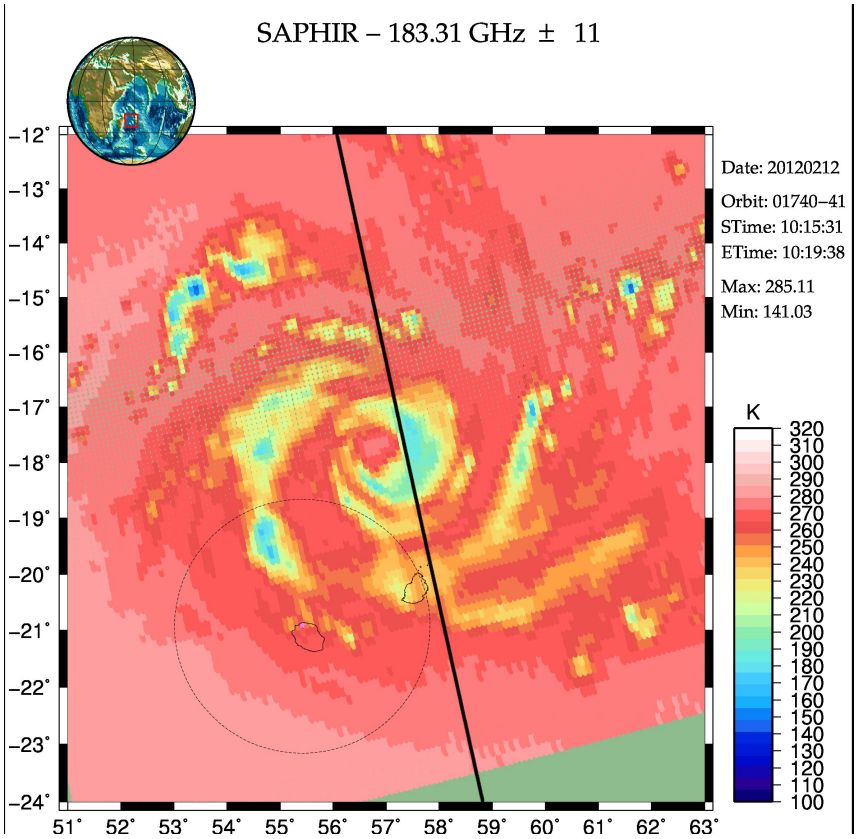
- 6 storms: Fina (19/12/2011), Jasmine (10/02/2012), Giovanna (12/02/2012), Guchol (19/06/2012), Ernesto (06/08/2012), Felleng (29/01/2013)
- Ice Content computed from Z-R given by Fontaine *et al.* 2015 (for tropical oceanic condition, MT-II/CINDY-DYNAMO)
- Vertically averaged CPR data into 1 km-thick layers from 4 to 18 km
- T, RH and P from ECMWF-Aux files
- Horizontally averaged CPR data to the SAPHIR-compatible resolution
- For each layer and each channel: computation of the co-variance
- We did not filter out the possible cases of MS

# Hurricane Giovanna 12/02/2012

## Channel S3

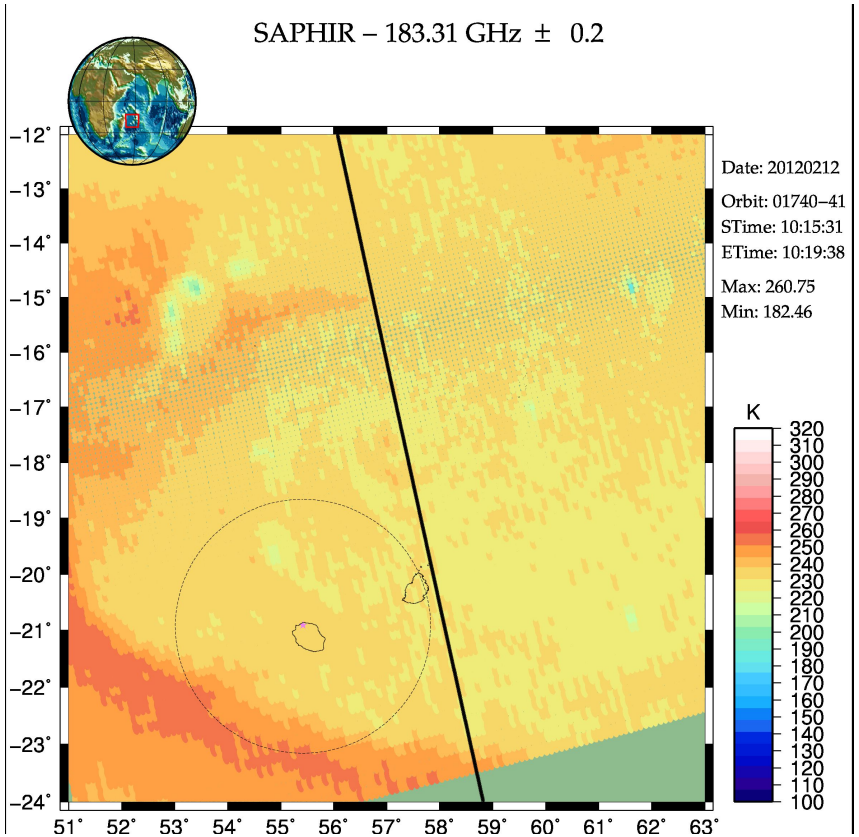



## Channel S6

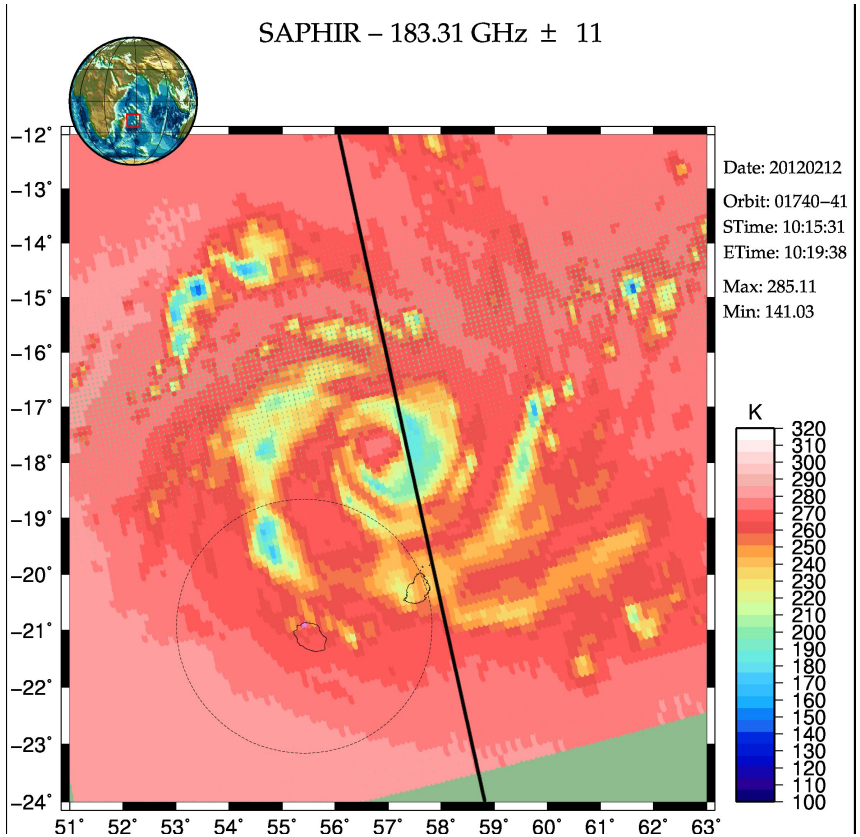


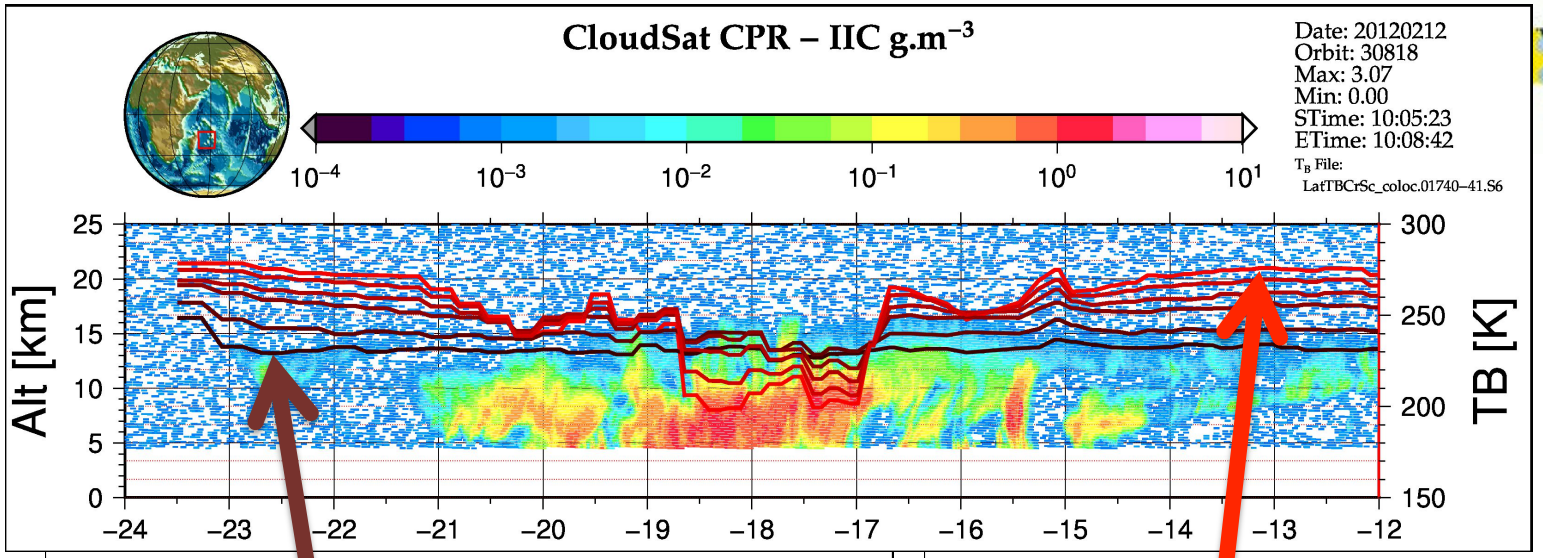
# Hurricane Giovanna 12/02/2012

## Channel S1

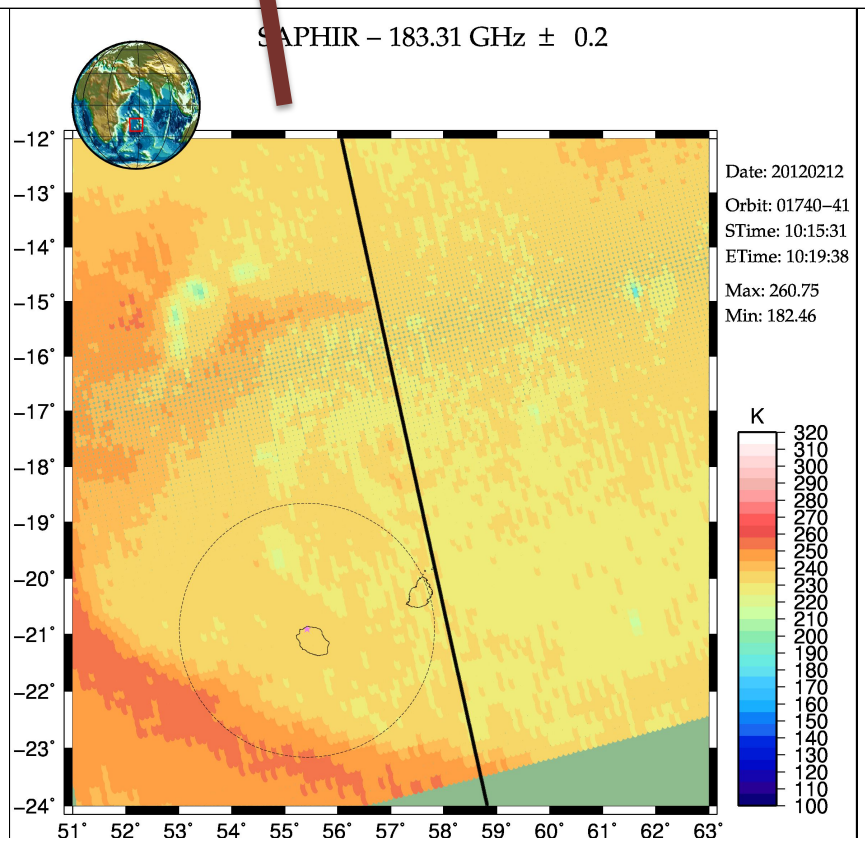


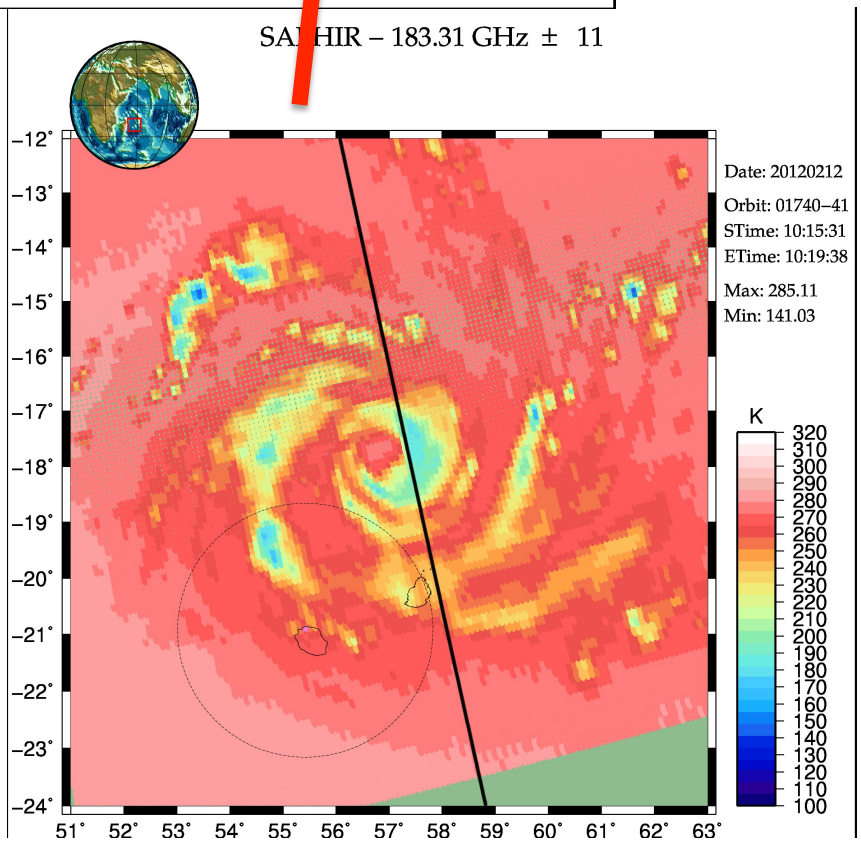

## Channel S6






Co-location with Cloudsat

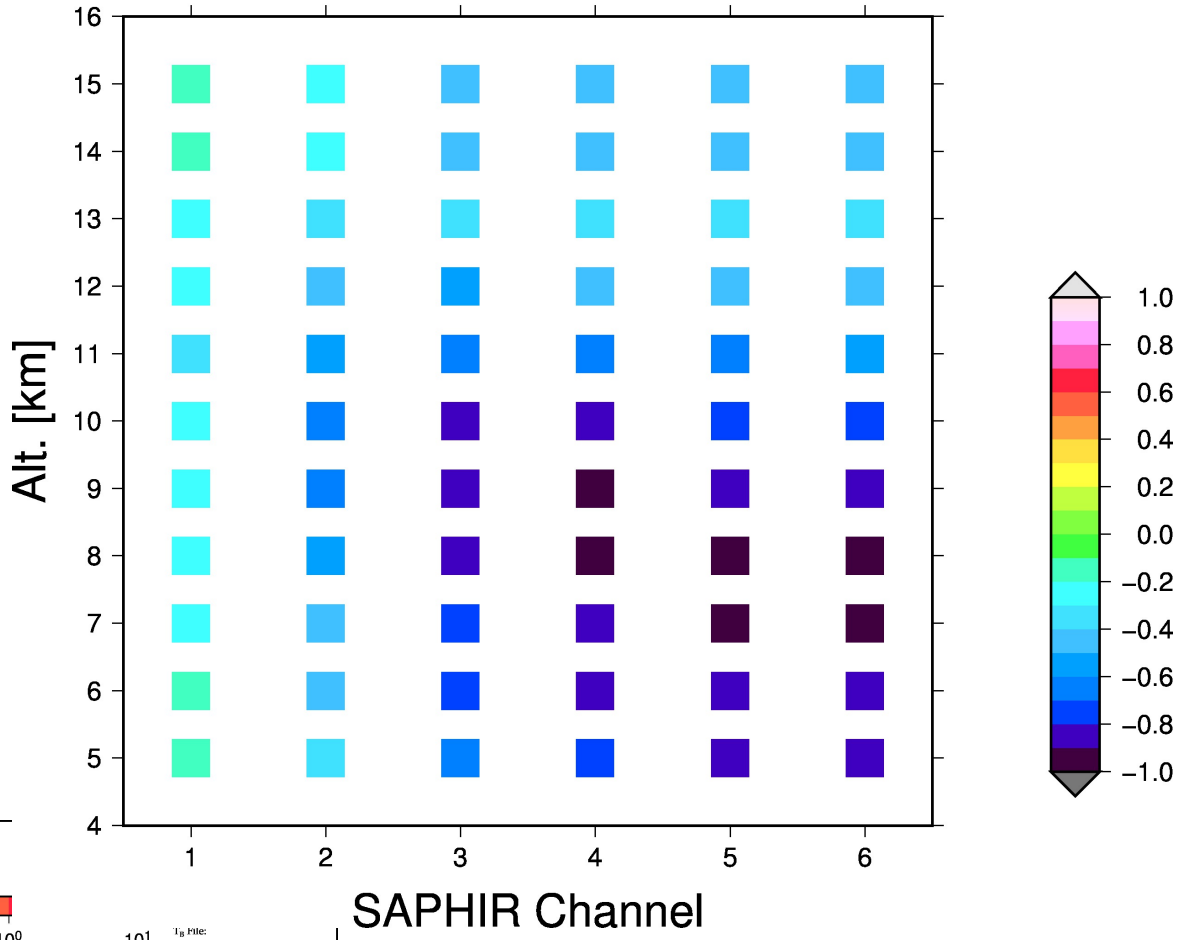


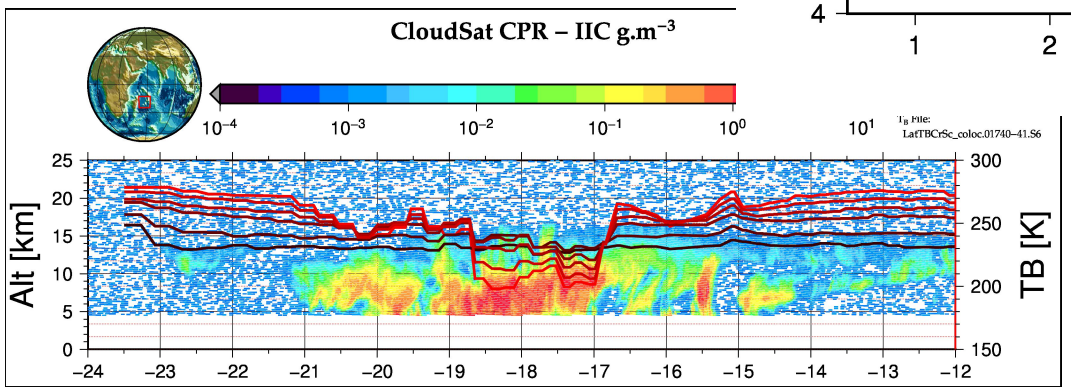



# Correlation IIC–Tb

## Correlation for Giovanna

- Deep eyewall convection ($IC_{max}$~3 $g.m^{-3}$)
- S1 almost not affected
- S2 affected mostly at 9-10 km but weakly
- S3-S6 well affected with an altitude dependence
- Negative correlation (scattering)
- Little impact above 12-13 km

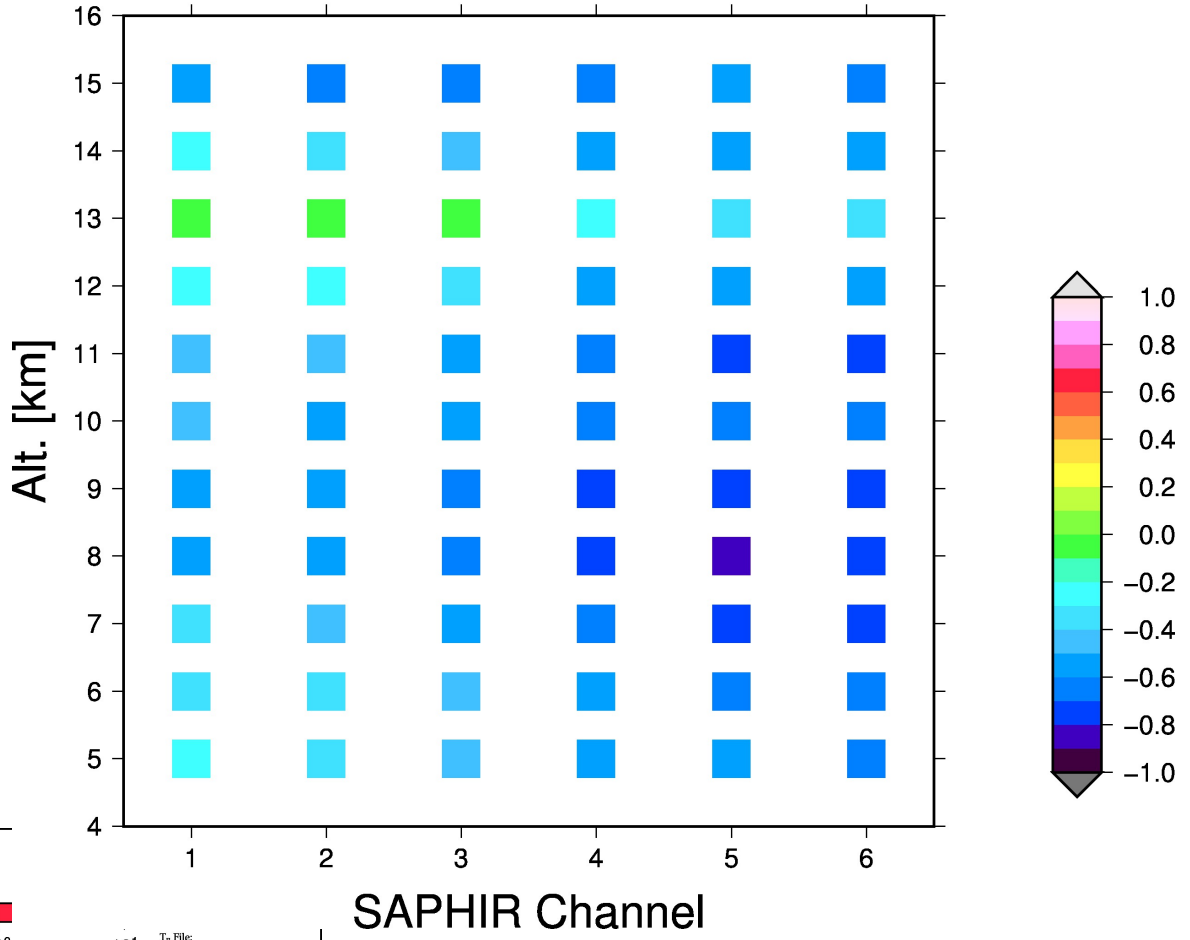


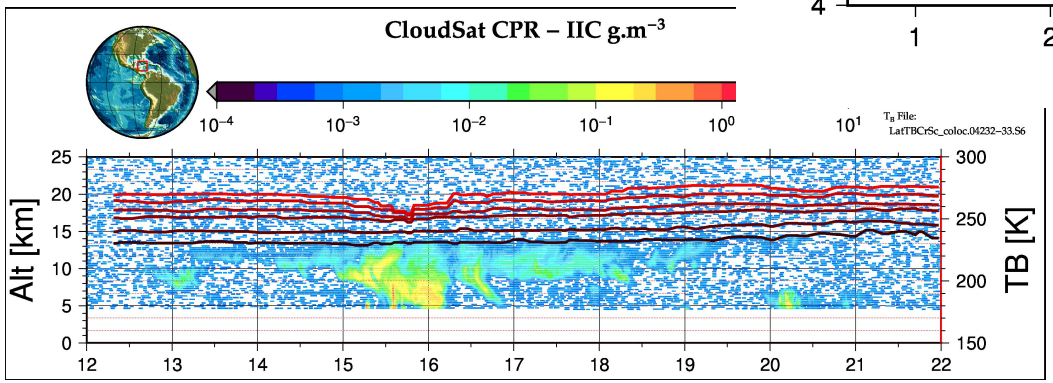



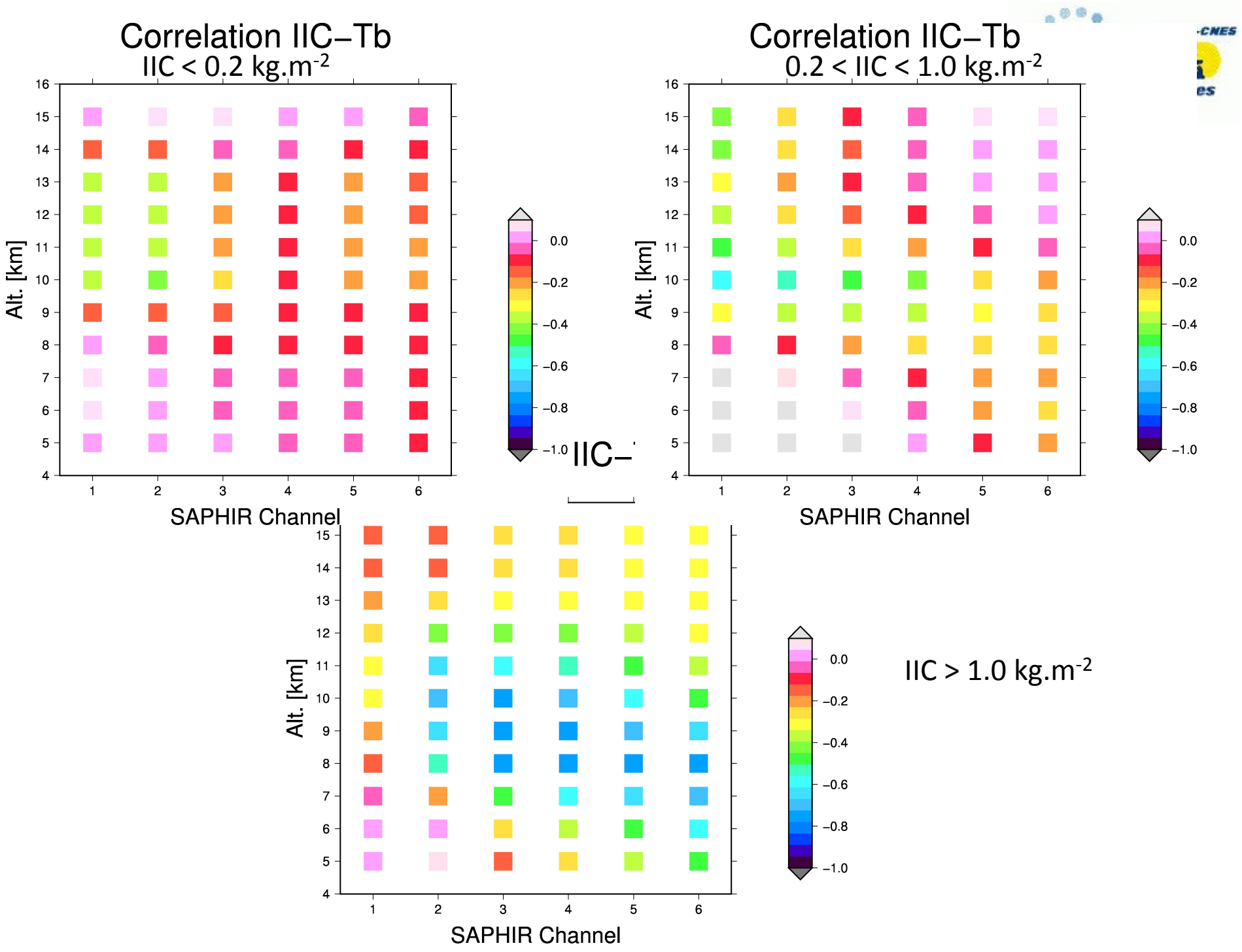
# Correlation IIC–Tb

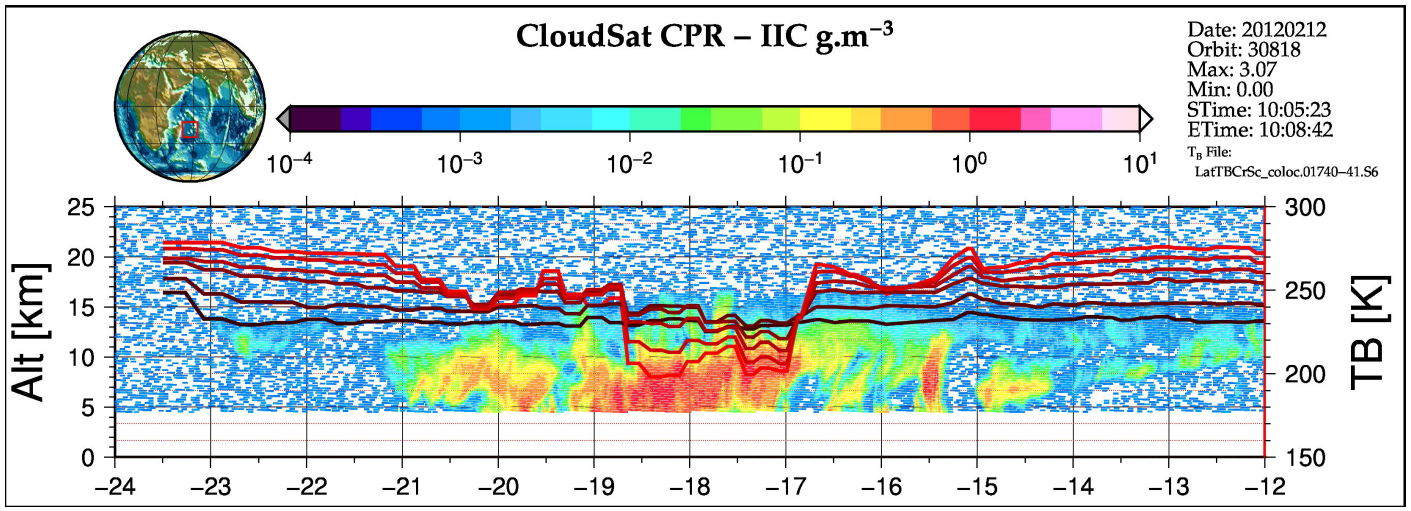
## Correlation for Ernesto

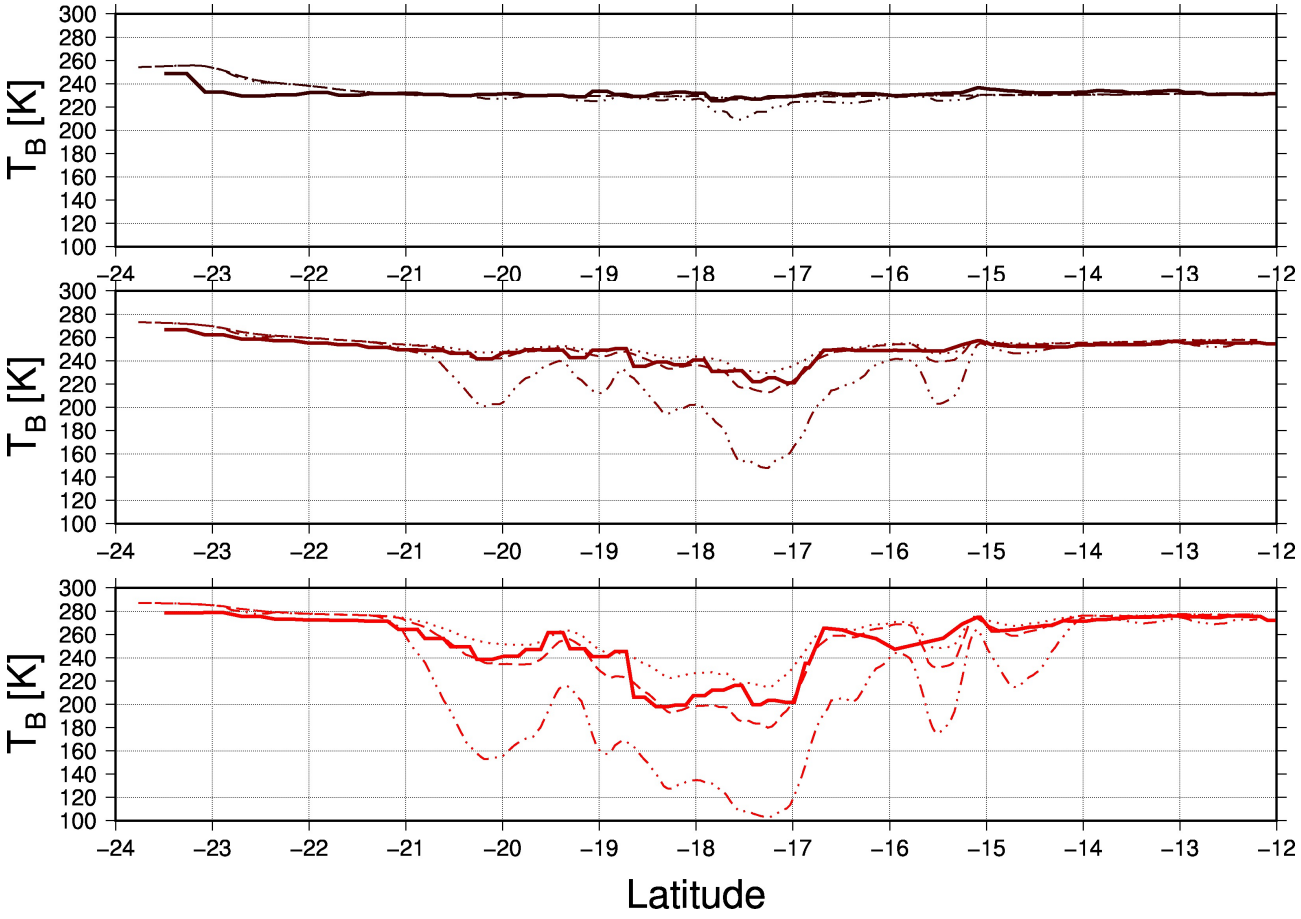
- Isolated weak convection ($IC_{max}$~1 $g.m^{-3}$)
- S1-S3 very similar
- S4-S6 very similar with max correlation at about 8 km
- Correlation at 15 km ?




Correlation IIC–Tb
IIC < 0.2 kg.m-2
Alt. [km]
SAPHIR Channel
Correlation IIC–Tb
0.2 < IIC < 1.0 kg.m-2
Alt. [km]
SAPHIR Channel
IIC–
Alt. [km]
SAPHIR Channel
IIC > 1.0 kg.m-2




__ Obs
..- Thick Snow
--- Sector Snow
.... Dendrite Snow

# Conclusions and Perspectives

- Looked at SAPHIR scattering regime
  - Sounding capabilities persists
  - Complex signal made of emission/scattering
- For frozen hydrometeors studies
  - A lot of informations on the vertical ice distrib.
  - Not necessarily the same param. for ice as 37-89 GHz
- For rain retrieval
  - Channels will saturate
  - Contributing emission => underestimation

-o-

## Correlation for Giovanna

- Deep eyewall convection ($IC_{max}$~3 $g.m^{-3}$)
- S1 almost not affected
- S2 affected mostly at 9-10 km but weakly
- S3-S6 well affected with an altitude dependence
- Negative correlation (scattering)
- Little impact above 12-13 km